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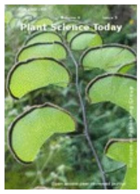

Research Article

Effects of exogenous and foliar applications of Brassinosteroid (BRs) and salt stress on the growth, yield and physiological parameters of *Lycopersicon esculentum* (Mill.)

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Abstract

The germination response of *Lycopersicon esculentum* was studied on different salinity levels from control (non-saline), 0.2,0.4,0.6 and 0.8% NaCl solution. Seeds germinating under salt stress exhibited decrease in saline media as compared to respective control. Seeds germinating with salinity and brassinosteroid (applied exogenously through roots and as foliar spray, 0.25 and 0.5 ppm) exhibited promotion in control as compared to their respective saline media. Plants treated with different salts concentrations (60 and 100mM) NaCl exhibited reduction in plant height, root length, number of leaves, number of fruits and biomass as compared to control while brassinosteroid having concentrations of 0.25 and 0.5 ppm (applied through roots and as foliar spray) caused promotion in plant height, root length, number of leaves, number of fruits and biomass in saline and non saline media. Plants treated with different salts concentration of (60 and 100mM) NaCl exhibited increase in Relative water content, leaf water loss, electrolyte leakage, shoot/- root ratio, root/- weight ratio and leaf/- weight ratio at both NaCl concentrations (60 and 100 mM) as compared to control, while stem/- weight ratio showed reduction at both salinity levels as compared to control while brassinosteroid applied in roots and as a foliar spray at 0.25 and 0.5 ppm concentrations exhibited reduction in stem/- weight ratio at high NaCl level (100 mM) as compared to control.

Keywords: Brassinosteroid; salt stress; *Lycopersicon esculentum*

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Introduction

Salinity refers to the occurrence of various salts in soil or water in concentration that may interfere with the growth of plants (Khan *et al.,* 2001). The total area of saline soils in the world is 397 million hac. In the current 230 million ha of irrigated land 45 million hac are salt-affected which is (19.5 percent) of the total irrigated land. Amongst the1500 million hac of dry land agriculture, 32 million hac are salt-affected land which is (2.1 percent) of the total dry agricultural land (FAO, 2004).

Globally more than 77 million hac of land is salt-affected by human-induced salinization (FAO, 2004). The total geographical areas of Pakistan is 80.0 million hac, with a very good canal irrigated system of about 62,400 km long and mainly confined to Indus plain covering an area of 19.43 million hac. In Pakistan, about 6.30 million hac of land are salt-affected and of which 1.89 hac is saline, 1.85 million hac is permeable saline-sodic, 1.02 million hac is impermeable saline-sodic and 0.028 million hac is sodic in nature. It is estimated that out of 1.89 million hac saline patches, 0.45 million hac present in Punjab, 0.94 million hac in Sindh and 0.5 million hac in KPK (Cao, *et al.,* 2010).

Tomato *(Lycopersicon esculentum)* is one of the most important vegetable worldwide which belongs to the Solanaceae family. World tomato production in 2001 was about 105 million tones of fresh fruit from an estimated 3.9 million hac. It is cultivated over an area of 4528519 hac with the production of 124748282 million tones on global level. In Pakistan it is cultivated over an area of 46.2 thousand hac with the production of 468.1 thousand tones giving yield of 10.1 tons per hac (Statistical year book of Pakistan, 2005-2006) which is quite low as compared to other developing countries like Iran, India, and Bangladesh. Tomato is widely used in making food dishes and contains significant amount of vitamin A and C. It is one of the most widely cultivated crop in the world and an important cash crop for smallholders and medium-scale commercial farmers (Borguini and Torres, 2009).

Brassinosteroid have been reported to counteract both abiotic and biotic stress in plants, increase the removal of pesticides, tolerance to high temperature, protective role on shoot, root length, soluble protein and peroxidases along with proline content in addition to leaf bending and cell elongation (Alam *et al.,*2006).

Brassinosteroid effects source to sink relationships, proton pumping, membrane polarization and stress responses including thermo tolerance and senescence. It also promote vascular differentiation and reorientation of microtubules (Xiojian *et al.,* 2009).

Brassinosteroid are endogenous plant hormones essential for the proper regulation of multiple physiological processes required for normal plant growth and development (Adams, 2009). Promotion of cells, expansion and cell elongation takes place after application of Brassinosteroid. It has an unclear role in cell division and cell wall regeneration. It is necessary for pollen elongation, pollen tube formation. It provide some protection to plants during chilling and drought stress (Knight *et al.,* 1992).

2 Materials and Methods

2.1 Growth experiment

Plant height, Root length, number of leaves, leaf area, number of fruits, fresh and dry biomass (g) were recorded in harvested plants. Root/- weight ratio, shoot/- weight ratio, Leaf/- weight ratio, shoot/- root ratio, Leaf area ratio (LAR), Specific leaf ratio (SLA) were calculated as described by Hunt (1982).

Root/- weight ratio (RWR) = Total root dry weight /Total plant dry weight

Shoot/- weight ratio (SWR) = Shoot dry weight /Total plants dry weight

Leaf/- weight ratio (LWR) = Total leaf dry weight/Total plant dry weight

Shoot /-root weight ratio (SRR) = Shoot dry weight /Root dry weight

Specific leaf area (SLA) = Total leaf area/Total leaf dry weight

Leaf area ratio (LAR) = Total plant leaf area /Total plant dry weight

Electrolyte leakage (EL), Leaf water loss (LWL), Relative water content (RWC) were calculated from fresh leaves.

Electrolyctic leakage was measured as described by Lutts *et al.,* (2004) with a few modifications. Plant material 0.3g was washed with deionized water. Place in tubes with 15ml of deionized water and incubated for 2 hrs at 25ºC. Electrical conductivity of the solution (L_1) was determined. Samples were then autoclaved at 120°c for 20 min and the final electrical conductivity (L_2) was measured after equilibrium at 25°C. EL was measured using the following formula; EL (%) $=L_1/L2*100$

Relative water contents was determined using the method described by Mata and Lamattina (2001). Fresh weight of leaves (FW) was measured then leaves were subjected to rehydration for two hrs in distilled water and their turgor weight (TW) was measured. Leaf samples were placed in a pre-heated oven at 80°C for 48 hrs, in order to obtain dry mass (DM). Relative water content (RWC) was calculated using the following formula.

RWC (%) = (FW-DW)/ (TW-DW)*100

Leaf water loss was measured as described by Clark and McCaig, (1982). Fresh weight (FW) of leaves was determined and leaves were kept for 2 hrs at 30ºC .After two hrs leaves were weighted again and leaf water loss (LWL) was calculated using the following formula.

3 Results and Discussion

3.1 Growth studies

3.1.1 Plant height

Plants grown in different sets (Set I-V) showed significant ($P<0.001$) decrease in plant height in 60mM and 100mM NaCl stress as compared to non-saline control (Figure 1, Table 1). When we compare Set II with Set III, plants of Set II showed decrease in

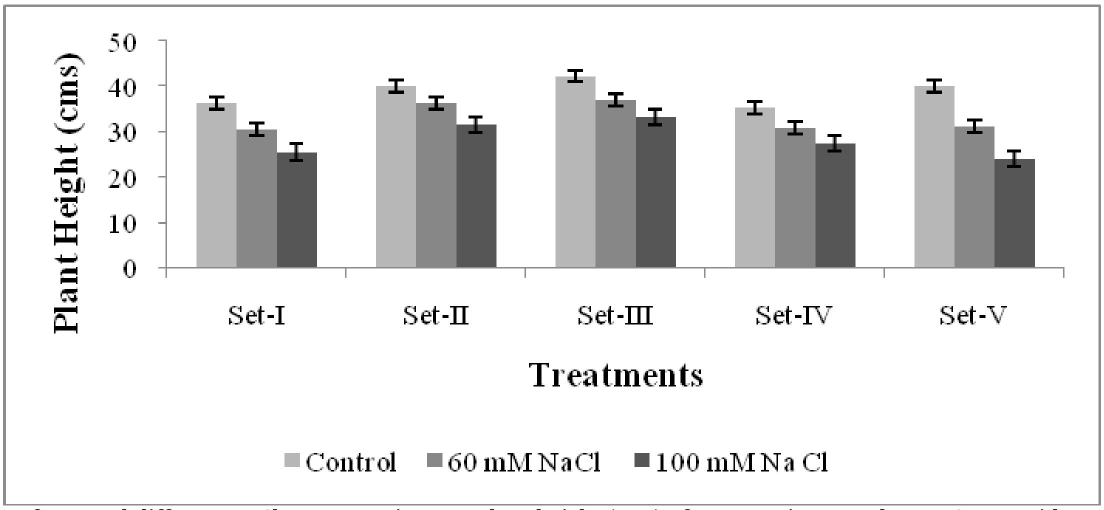

Fig. 1. Effect of BRs and different NaCl concentrations on plant height (cms) of *Lycopersicon esculenum*. Set I= Without BRs, Set II= 0.25 ppm BRs applied in roots, Set III= 0.50 ppm BRs applied in roots, Set IV= 0.25 ppm BRs applied foliarly, Set V= 0.50 ppm BRs applied folarialy.

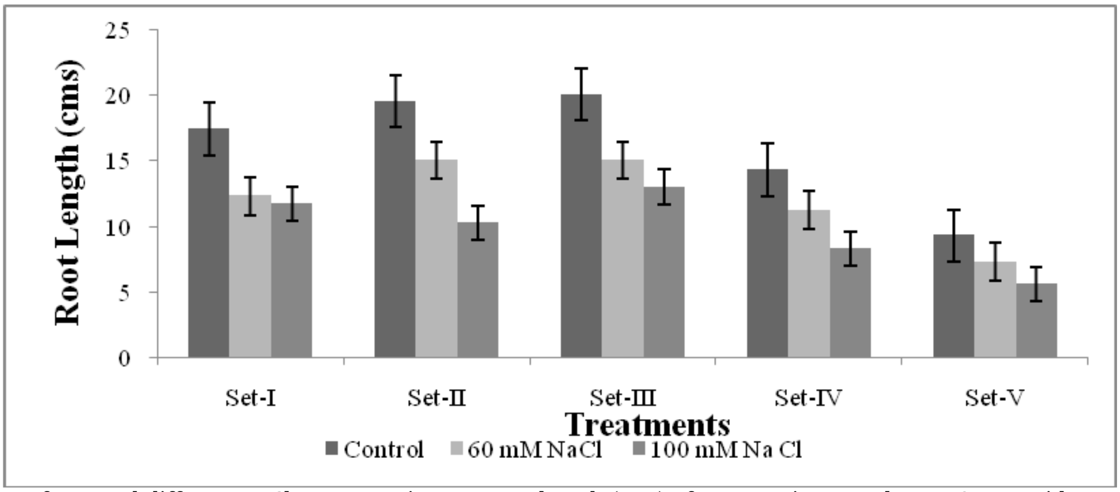

Fig. 2. Effect of BRs and different NaCl concentrations on root length (cms) of *Lycopersicon esculenum*. Set I= Without BRs, Set II= 0.25 ppm BRs applied in roots, Set III= 0.50 ppm BRs applied in roots, Set IV= 0.25 ppm BRs applied foliarly, Set V= 0.50 ppm BRs applied folarialy.

plant height as compare to Set III in control as well as in saline condition. Comparison between Set IV and V showed that plants of Set IV showed decrease in plant height as compared to Set V in control as well as in saline condition. Comparison of Set II, Set III Set IV and V with Set I we observed that all four sets showed increase in plant height as compared to Set I in saline as well as in non-saline condition. The effect was previously studied by Ashraf (1994) that Plant height of tomato plants significantly reduced due to imposition of salt stress, particularly at the highest external NaCl regime.

3.3.2 Root length

Plants grown in different sets (Set I-V) showed significant ($P<0.001$) decrease in root length in 60mM and 100mM NaCl stress as compare to non-saline control (Figure 2, Table 1). When we compare Set II with Set III, plants of Set II showed decrease in root length as compare with Set III in control as well as in saline condition. Comparison between Set IV and V showed that plants of Set IV showed decrease in root length as compare to Set V in control as well as in saline condition. If we compare Set II and Set III with Set I we observed that plant of Set I showed decrease in root length as compared to Set II and Set III in control as well as in saline condition. Comparison of Set I with Set IV and V showed decrease in root length in Set IV and V as compare to Set I in saline as well as in non-saline conditions. Same effect was previously studied by Hayat *et al.* (2000) that application of 0.50 ppm brassinosteroid in roots and as a foliar application root length of stressed tomato plants increased.

3.3.3 Number of leaves

Plants grown in different sets (Set I-V) showed significant ($P<0.001$) decrease in number of leaves in both NaCl stress as compare to non-saline control (Figure 3, Table 1). When we compare Set II with Set III plants of Set II showed decrease in number of leaves as compared to Set III in control as well as in saline condition. While comparison between Set IV and V showed that plants of Set V exhibited decrease in number of leaves as compare to Set IV in control as well as in saline conditions. If we compare Set II and Set III with Set I we observed that plant of both sets showed increase in number of leaves as

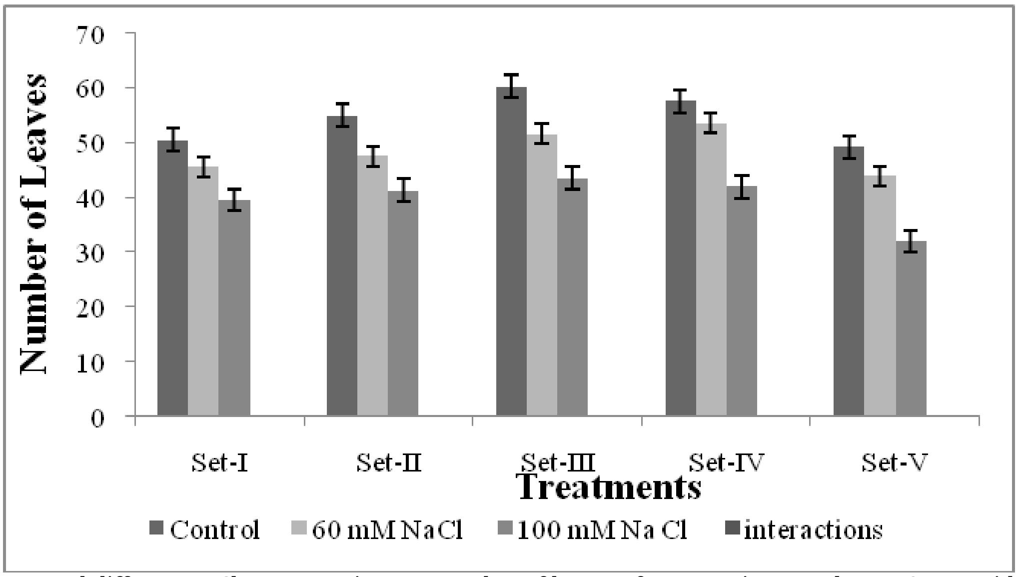

Fig. 3. Effect of BRs and different NaCl concentrations on number of leaves of *Lycopersicon esculenum*. Set I= Without BRs, Set II= 0.25 ppm BRs applied in roots, Set III= 0.50 ppm BRs applied in roots, Set IV= 0.25 ppm BRs applied foliarly, Set V= 0.50 ppm BRs applied folarialy.

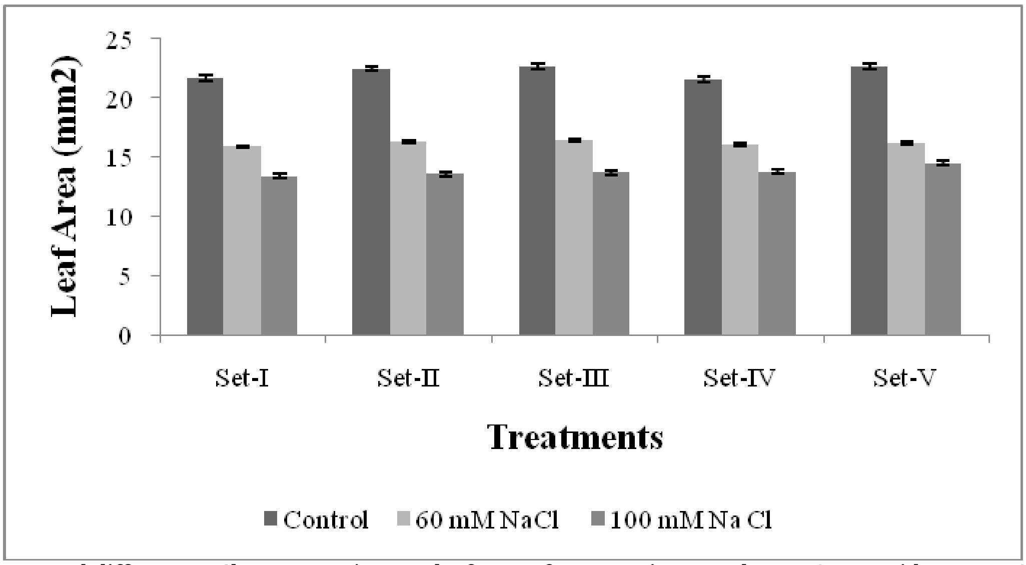

Fig. 4. Effect of BRs and different NaCl concentrations on leaf area of *Lycopersicon esculenum*. Set I= Without BRs, Set II= 0.25 ppm BRs applied in roots, Set III= 0.50 ppm BRs applied in roots, Set IV= 0.25 ppm BRs applied foliarly, Set V= 0.50 ppm BRs applied folarialy.

compare to Set I in control as well as in saline conditions. Comparison of Set I with Set IV and V showed increase in number of leaves in both sets as compare to Set I in saline as well as in non- saline condition. As previously studied by (Ball *et al.*, 1988) that application of brassinosteroid @ 0.50 ppm in roots and as a foliar spray was effective in improving number of leaves of tomato plants either under normal growth conditions and at different level of salt stress.

3.3.4 Leaf area

Plants grown in different sets (Set I-V) showed significant (P<0.001) decrease in leaf area in both concentrations of NaCl as compare to non-saline control (Figure 4, Table 1). When we compare Set II with Set III plants of Set II showed decrease in leaf area as compare to Set III in control as well as in saline conditions. Comparison between Set IV and V showed that plants of Set IV showed decrease in leaf area as compared to Set V in control as well as in saline conditions. If we compare Set II, Set III, Set IV and V with Set I we observed that plants of all 4 sets showed increase in leaf area as compared to Set I in control as well as in saline condition. As agreed with the previous work of Munns (2005) who stated that total leaf area per tomato plant decreased proportionally under 100mM salt stress whereas an increase was shown by different foliar spray of medium (brassinosteroid @ 0.25 and 0.5 ppm) in control as well as in plants growing under saline water irrigation.

3.3.5 Number of fruits

Plants grown in different sets (Set I-V) showed significant (P<0.001) decrease in number of fruits in 60mM and 100mM NaCl stress as compare to non-saline control (Figure 5, Table 2). When we compare

Table 1. ANOVA for different growth parameters in *Lycopersicon esculentum* grown in different NaCl levels and BRs doses.

Source	Plant height	Root length	Number of leaves	Leaf area
Application	Ns	P<0.05	Ns	P<0.05
BRs	P<0.001	P<0.001	P<0.01	P<0.01
Salinity	P<0.001	P<0.001	P<0.001	P<0.001
Application x BRs	Ns	P<0.001	P<0.001	Ns
Application x salinity	Ns	Ns	Ns	Ns
BRs x salinity	Ns	Ns	Ns	Ns
Application x BRs x salinity	Ns	Ns	Ns	Ns

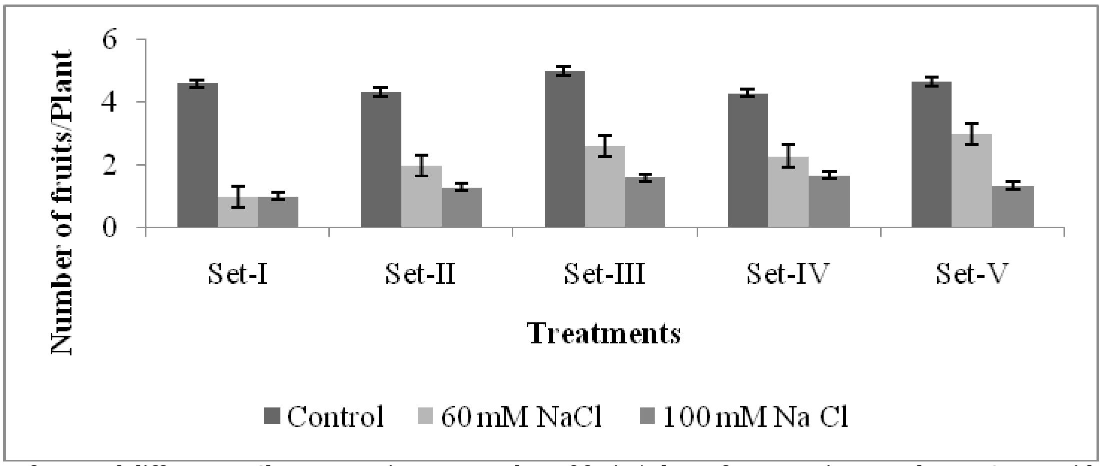

Fig. 5. Effect of BRs and different NaCl concentrations on number of fruits/ plant of *Lycopersicon esculenum*. Set I= Without BRs, Set II= 0.25 ppm BRs applied in roots, Set III= 0.50 ppm BRs applied in roots, Set IV= 0.25 ppm BRs applied foliarly, Set V= 0.50 ppm BRs applied folarialy.

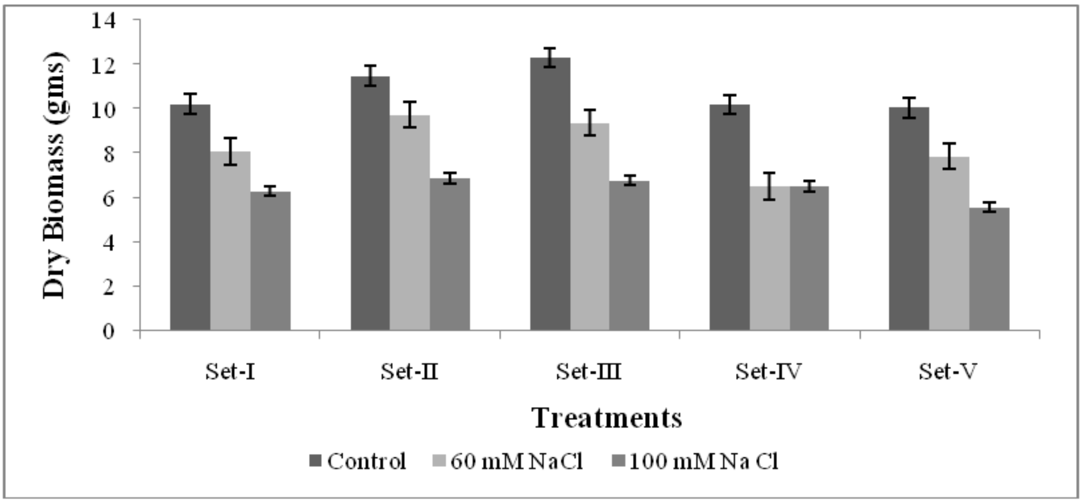

Fig. 6. Effect of BRs and different NaCl concentrations on plant fresh biomass of *Lycopersicon esculenum*. Set I= Without BRs, Set II= 0.25 ppm BRs applied in roots, Set III = 0.50 ppm BRs applied in roots, Set IV= 0.25 ppm BRs applied foliarly, Set V= 0.50 ppm BRs applied folarialy.

Set II with Set III plants of Set II showed decrease in number of fruits as compare to Set III in control as well as in saline conditions. Comparison between Set IV and V showed that plants of Set IV showed decrease in number of fruits as compared to Set V in control as well as in saline conditions. If we compare Set II, Set III, Set IV and V with Set I we observed that plants of Set III and V showed increase in number of fruits as compared to Set I in control as well as in saline condition. Also previously studied by Ball and Farquhar (1984) that tomato grown in the NaCl possessed a comparatively lower number of fruit yield per plant at harvest stage.

3.3.6 Fresh and dry biomass

Plants grown in different sets (Set I-V) showed significant (P<0.001) reduction in fresh and dry bio mass in NaCl stress as compare to non-saline control (Figure 6-7, Table 2). When we compare Set II with Set III plants of Set III showed increase in fresh

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Table 2. ANOVA for plant biomass in *Lycopersicon esculentum* grown in different NaCl levels and BRs doses.

Source	Number of fruits	Fresh biomass	Dry biomass
Application	Ns	Ns	Ns
BRs	Ns	P<0.001	P<0.001
Salinity	P<0.001	P<0.001	P<0.001
Application x BRs	Ns	P<0.05	Ns
Application x salinity	Ns	Ns	Ns
BRs x salinity	Ns	Ns	Ns
Application x BRs x salinity	Ns	Ns	Ns

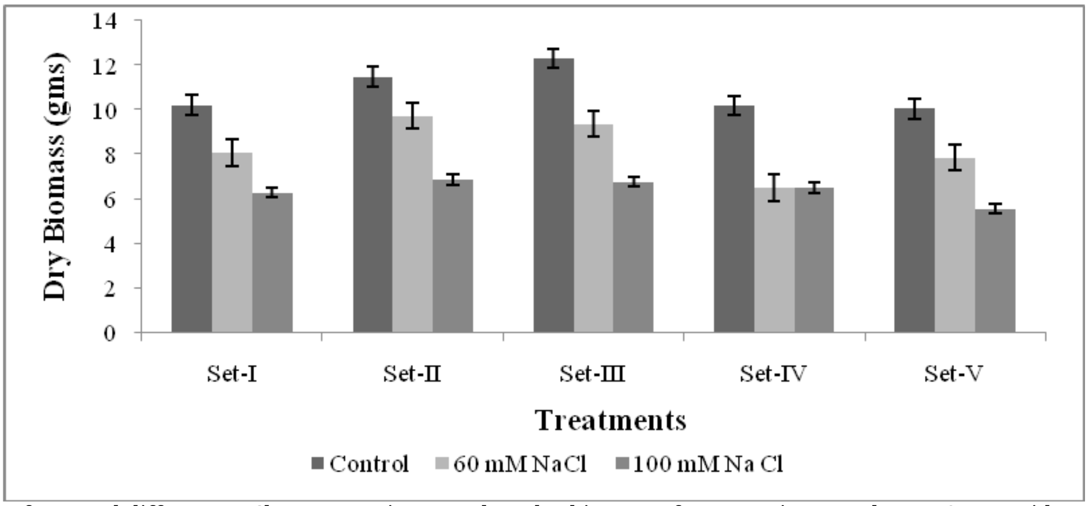

Fig. 7. Effect of BRs and different NaCl concentrations on plant dry biomass of *Lycopersicon esculenum*. Set I= Without BRs, Set II= 0.25 ppm BRs applied in roots, Set III= 0.50 ppm BRs applied in roots, Set IV= 0.25 ppm BRs applied foliarly, Set V= 0.50 ppm BRs applied folarialy.

biomass as compare to Set II in control as well as in saline conditions. While Set III showed increase in control and decrease in saline condition in total dry weight as compare to Set II. Comparison between Set IV and V showed that plants of Set V showed increase in control and decrease in saline condition in total fresh weight as compare to Set IV. While in case of dry biomass plants of Set V showed decrease in control and increase in dry bio mass as compare to Set IV. If we compare Set II, III, IV and V with Set I we observed that plant of Set III and IV showed increase in fresh biomass as compared to Set I in control as well as in saline conditions. While in case of dry biomass Set II and III showed increase in dry biomass as compare to Set I in saline as well as in non-saline conditions. Volkmal *et al.*,(1997) studied that the highest level of salt stress decrease biomass while brassinosteroid applied with a concentration of 0.25 and 0.5 ppm showed increase in fresh and dry biomass that NaCl-stress caused a decline in overall growth of plants due to reduced masses of fresh and dry materials of the various organs.

3.3.7 Electrolyte leakage (EL)

Plants grown in different sets (Set I, IV and V) showed non-significant decrease in electrolyte leakage in non saline control and 100mM NaCl stress as compare to 60mM NaCl. Set III showed non-significant increase in non-saline control as compare to 60mM NaCl and 100mM NaCl stress. Set II showed significant (P<0.05) decrease in non saline control as compared to saline conditions (Table 3). When we compare Set II with Set III, plants of Set II showed decrease in electrolyte leakage in non-saline control and 100mM NaCl stress as while exhibited increase in 60mM NaCl as compared to Set III. Comparison between Set IV and V showed that plants of Set IV showed increase in electrolyte leakage in non-saline control and 100mM NaCl while exhibited decrease in 60mM NaCl as compare to Set V in control as well as in saline condition. If we compare Set II with Set I we observed that plants of Set II showed increase in non-saline control and saline conditions. If we compare Set III, IV and V with Set I we observed that plants of all three sets showed increase in electrolyte leakage in non-saline control and 100mM NaCl while exhibited decrease in 60mM NaCl as compare to Set I in control as well as in saline condition. These results are concordant with Ali *et al.*, (2008) for mustard that brassinosteroid reduced partially the electrolyte leakage induced by NaCl-stress.

3.3.8 Leaf water loss (LWL)

Plants grown in different sets (I, III, and V) showed non-significant increase in leaf water loss in100mM NaCl stress as compare to 60mM NaCl and non-saline control. While plants of Set II showed non-significant increase in 60mM NaCl as

Table 3. ANOVA for effects of BRs and different NaCl concentrations on relative water content, Electrolyte leakage and leaf water loss of *Lycopersicon esculentum.*

Set I = Without BRs

Treatment	Relative water content	Electrolyte leakage	Leaf water loss
Control, Mean, SE	0.92a ± 0.23	84.40a ± 2.86	62.50a ± 39.71
60mM NaCl, Mean, SE	1.24a ± 0.273	80.50a± 3.594	95.08a ±12.406
% (+/-)	(+34.70)	(-4.63)	(+51.90)
100mM NaCl, Mean, SE	1.80 a ± 0.399	75.70a ± 6.078	67.02a ±22.073
% (+/-)	(+18.3)	(-10.23)	(+7.09)
$LSD_{0.05}$	0.99	44.99	475.5

Set II = 0.25ppm BRs applied through roots

Treatment	Relative Water Content	Electrolyte leakage	Leaf Water Loss
Control, Mean, SE	1.71a ± 0.172	60.70a ± 21.49	79.90a ± 14.125
60mM NaCl, Mean, SE	2.50a ± 0.282	76.20a ± 3.81	89.20ab ± 22.98
% (+/-)	(+47.70)	(+25.40)	(+11.60)
100mM NaCl, Mean, SE	1.50a ± 0.25	88.0a ± 1.36	83.50b ±15.85
% (+/-)	(+63.70)	(+44.70)	(+4.40)
$LSD_{0.05}$	0.84	43.70	62.53

Set III = 0.50 ppm BRs applied in roots

Treatment	Relative Water Content	Electrolyte leakage	Leaf Water Loss
Control, Mean, SE	1.4a ±0.4004	86.3a ±1.618	158.1a ±77.321
60mM NaCl, Mean, SE	1.004a ±0.23	89.2a ± 0.633	68.07a ± 23.617
% (+/-)	(-28.73)	(+3.38)	(-56.94)
100mM NaCl, Mean, SE	1.40a ±0.23	85.08a ±1.398	133.1a ±62.617
% (+/-)	(-41.38)	(-1.42)	(-15.77)
$LSD_{0.05}$	1.034	4.5	204.3

Set IV = 0.25 ppm BRs applied as a foliar spray

Treatment	Relative Water Content	Electrolyte leakage	Leaf Water Loss
Control, Mean, SE	1.6a ±0.093	84.06a ±2.56	68.7a ±14.65
60mM NaCl, Mean, SE	1.49a ±0.299	78.9a ±6.34	118.1a ±42.43
% (+/-)	(-7.27)	(-6.10)	(+71.8)
100mM NaCl, Mean, SE	1.2a ±0.48	88.5a ±2.52	87.1a ±16.655
% (+/-)	(+221)	(+5.28)	(+26.8)
$LSD_{0.05}$	1.16	387.2	95.7

Set V= 0.50 ppm BRs applied as a foliar spray

Treatment	Relative Water Content	Electrolyte leakage	Leaf Water Loss
Control, Mean, SE	1.1a ±0.237	85.8a ±0.715	64.2a ±5.364
60mM NaCl, Mean, SE	1.5a ±0.223	86.8a ±6.094	87.8a ±30.522
% (+/-)	(+38.2)	(+1.16)	(+36.8)
100mM NaCl, Mean, SE	1.7a ±0.739	92.2a ±0.754	84.03a ±3.782
% (+/-)	(-5.727)	(+751.3)	(+468.9)
$LSD_{0.05}$	1.61	12.36	62.4

Means followed by different letters in the same column differ significantly at 95% probability level according to New Duncan's Multiple Range Test. Figures in parentheses indicate % promotion (+) and reduction (-) over control.

compare to non-saline control and 100mM NaCl. Plants of Set IV showed non-significant increase in control as compare to saline conditions (Table 3). When we compare Set II with Set III, plants of Set II showed increase in leaf water loss as compare to Set III in control as well as in saline condition. Comparison between Set IV and V showed that plants of Set IV showed increase in control while exhibited decrease in 60mM and 100mM NaCl in leaf water loss as compare to Set V. If we compare Set II, Set III, Set IV and V with Set I we observed that plants of all four set showed increase in leaf water loss in non-saline control and 100mM NaCl while showed decrease in 60mM NaCl as compare to Set I.

3.3.9 Relative water content (RWC)

Plants grown in Set I showed non-significant decrease in relative water contents in 60mM and 100mM NaCl as compare to control. Plants of Set II, Set IV and V showed non-significant increase in 100mM NaCl treated plants as compare to non-saline control and 60mM NaCl stress. While plants of Set III showed non-significant increase in 60mM NaCl as compare to non saline control and 100mM NaCl stress (Table 3). When we compare Set II with Set III, plants of Set II showed decrease in relative water

Table 4. Effect of BRs and different NaCl concentrations on Shoot/root ratio of *Lycopersicon esculentum*

Set I= Without BRs

Treatment	Shoot Dry Wt (gms)	Root Dry Wt (gms)	Shoot/Root Ratio
Control, Mean, SE	7.53a ±0.155	0.975a ±0.02	7.72a ±0.002
60mM NaCl, Mean, SE	5.5ab ±1.14	0.65a ±0.04	8.67a ±2.30
% (+/-)	(-26.95)	(-33.33)	(+12.37)
100mM NaCl, Mean, SE	4.97b ±0.069	1.0b ±0.612	4.97a ±0.201
% (+/-)	(-33.99)	(+2.56)	(-35.64)
$LSD_{0.05}$	2.260	0.199	3.870

Set II= 0.25ppm BRs applied through roots.

Treatment	Shoot Dry Wt (gms)	Root Dry Wt (gms)	Shoot/Root Ratio
Control, Mean, SE	8.88a ±0.032	1.125a ±0.028	7.9a ±0.229
60mM NaCl, Mean, SE	7.64b ±0.155	0.905b ±0.012	8.44b ±0.057
% (+/-)	(-13.96)	(-19.55)	(+6.81)
100mM NaCl, Mean, SE	5.2c ±0.326	0.96b ±0.274	5.41b ±0.034
% (+/-)	(-41.38)	(-14.66)	(-31.41)
$LSD_{0.05}$	0.686	0.161	0.665

Set III= 0.50ppm BRs applied through roots.

Treatment	Shoot Dry Wt (gms)	Root Dry Wt (gms)	Shoot/Root Ratio
Control, Mean, SE	9.75a ±0.228	1.415a ±0.036	6.9a ±0.34
60mM NaCl, Mean, SE	7.91b ±0.489	0.94a ±0.024	8.44a ±0.741
% (+/-)	(-18.87)	(-33.56)	(+22.30)
100mM NaCl, Mean, SE	5.08c ±0.889	0.93a ±0.518	5.84a ±1.45
% (+/-)	(-47.89)	(-34.27)	(-15.32)
$LSD_{0.05}$	3.450	0.446	1.010

Set IV= 0.25ppm BRs applied foliarly.

Treatment	Shoot Dry Wt (gms)	Root Dry Wt (gms)	Shoot/Root Ratio
Control, Mean, SE	8.575a ±0.281	0.935a ±0.02	9.167a ±0.101
60mM NaCl, Mean, SE	7.09b ±0.138	0.805b ±0.012	8.806a ±0.038
% (+/-)	(-17.31)	(-13.90)	(-3.94)
100mM NaCl, Mean, SE	5.057c ±0.234	0.716b ±0.18	7.135a ±0.02
% (+/-)	(-41.026)	(-23.42)	(-22.173)
$LSD_{0.05}$	2.030	0.133	3.850

Set V= 0.50ppm BRs applied foliarly.

Treatment	Shoot Dry Wt (gms)	Root Dry Wt (gms)	Shoot/Root Ratio
Control, Mean, SE	8.39a ±0.416	0.765a ±0.044	11.072a ±1.19
60mM NaCl, Mean, SE	6.295a ±1.23	0.7ab ±0.008	8.963b ±1.66
% (+/-)	(-24.97)	(-8.49)	(-19.04)
100mM NaCl, Mean, SE	4.5a ±0.142	0.575b ±0.195	7.842c ±0.07
% (+/-)	(-46.36)	(-24.83)	(-29.16)
$LSD_{0.05}$	2.170	0.186	11.667

Means followed by different letters in the same column differ significantly at 95% probability level according to New Duncan's Multiple Range Test. Figures in parentheses indicate % promotion (+) and reduction (-) over control.

contents in non-saline control and 60mM NaCl while decrease in 100mM NaCl as compare to Set III. Comparison between Set IV and V showed that plants of Set IV exhibited non-significant decrease in relative water content as compare to Set V. If we compare Set II, Set III, Set IV and V with Set I we observed that plants of all four sets showed increase in relative water contents in 100mM NaCl stress. Plants of Set II and Set IV showed decrease in non-saline control and 60mM NaCl stress as compared to Set I. Plants of Set III and Set V showed increase in non-saline control and 60mM NaCl stress as compare to Set I. Previously observe by Flower and Ludlow (1986) that salt stress significantly declined Leaf relative water content as compared to the control treatment.

3.3.10 Shoot root ratio (SRR)

Plants grown in Set I and Set III showed non-significant increase in 60mM NaCl stress and non-significant decrease in 100mM NaCl stress as compare to control. Plants of Set II showed non-significant increase in 60mM NaCl stress and non-

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Table 5. Effect of BRs and different NaCl concentrations on root weight ratio of *Lycopersicon esculentum*

Set I= Without BRs

Treatment	Total Root Dry Wt (gms)	Total Plant Dry Wt (gms)	Root Weight Ratio
Control, Mean, SE	0.95a ±0.04	9.87a ±0.106	0.096a ±0.003
60mM NaCl, Mean, SE	0.65a ±0.04	7.62ab ±1.12	0.089b ±0.018
% (+/-)	(-31.57)	(-22.79)	(-7.04)
100mM NaCl, Mean, SE	1b ±0.069	6.28b ±0.612	0.161b ±0.201
% (+/-)	(+5.26)	(-36.37)	(+67.91)
$LSD_{0.05}$	0.199	2.130	2.430

Set II= 0.25ppm BRs applied through roots.

Treatment	Total Root Dry Wt (gms)	Total Plant Dry Wt (gms)	Root Weight Ratio
Control, Mean, SE	1.125a ±0.028	11.26a ±0.048	0.0999a ±0.002
60mM NaCl, Mean, SE	0.905b ±0.012	9.795b ±0.118	0.092b ±0.0001
% (+/-)	(-19.55)	(-13.01)	(-7.54)
100mM NaCl, Mean, SE	0.96b ±0.326	6.705c ±0.273	0.143b ±0.034
% (+/-)	(-14.66)	(-40.45)	(+43.55)
$LSD_{0.05}$	0.161	0.680	0.016

Set III= 0.50ppm BRs applied through roots.

Treatment	Total Root Dry Wt (gms)	Total Plant Dry Wt (gms)	Root Weight Ratio
Control, Mean, SE	1.14a ±0.187	12.375a ±0.004	0.092a ±0.015
60mM NaCl, Mean, SE	0.94a ±0.024	9.585b ±0.355	0.098a ±0.006
% (+/-)	(-17.54)	(-22.54)	(+6.84)
100mM NaCl, Mean, SE	0.93a ±0.889	6.715c ±0.518	0.142b ±0.035
% (+/-)	(-18.42)	(-45.73)	(+54.79)
$LSD_{0.05}$	0.450	1.030	0.060

Set IV= 0.25ppm BRs applied as a foliar spray.

Treatment	Total Root Dry Wt (gms)	Total Plant Dry Wt (gms)	Root Weight Ratio
Control, Mean, SE	0.935a ±0.02	10.575a ±0.208	0.088a ±0.0001
60mM NaCl, Mean, SE	0.805ab ±0.012	8.9b ±0.187	0.094ab ±0.002
% (+/-)	(-13.90)	(-15.83)	(+6.38)
100mM NaCl, Mean, SE	0.716b ±0.234	6.59c ±0.18	0.101b ±0.004
% (+/-)	(-23.42)	(-37.67)	(+14.77)
$LSD_{0.05}$	0.150	0.930	0.065

Set V= 0.50ppm BRs applied as a foliar spray.

Treatment	Total Root Dry Wt (gms)	Total Plant Dry Wt (gms)	Root Weight Ratio
Control, Mean, SE	0.735a ±0.02	10.13a ±0.465	0.073a ±0.005
60mM NaCl, Mean, SE	0.7a ±0.008	7.67b ±1.21	0.094b ±0.013
% (+/-)	(-4.76)	(-24.28)	(+29.69)
100mM NaCl, Mean, SE	0.575b ±0.142	5.7c ±0.195	0.101b ±0.07
% (+/-)	(-21.76)	(-43.73)	(+38.72)
$LSD_{0.05}$	1.92	1.91	0.574

Means followed by different letters in the same column differ significantly at 95% probability level according to New Duncan's Multiple Range Test. Figures in parentheses indicate % promotion (+) and reduction (-) over control.

significant decrease in 100mM NaCl stress as compare to control plants. Plants grown in Set IV showed non-significant decrease while Set V showed significant ($P<0.05$) decrease in 60mM NaCl stress and 100mM NaCl stress over non saline control (Table 4).

When we compare Set II with Set III plants of Set II showed increase in non-saline control and 100mM NaCl stress as compare to Set III. Comparison between Set IV and V showed that plants of Set IV showed decrease in non-saline control, 60 and 100mM NaCl stress as compare to Set V. If we compare Set II, Set III, Set IV and V with Set I we observed that plants of Set III showed decrease while remaining all three sets showed increase in non-saline control. Plants of Set I-II showed decrease in 60mM NaCl while increase in Set III-IV in 100mM NaCl stress as compare to Set I.

3.3.11 Root weight ratio (RWR)

Plants grown in Set I and II showed significant ($P< 0.05$) decrease in root weight ratio at higher NaCl stress 100mM as compare to control (non saline).

Table 6. Effect of BRs and different NaCl concentrations on Stem weight ratio of *Lycopersicon esculentum.*

Set I= Without BRs

Treatment	Total stem dryWt (gms)	Total plant dry Wt (gms)	Stem Weight Ratio
Control, Mean, SE	2.350 ±0.04	9.880 ±0.114	0.237a ±0.006
60mM NaCl, Mean, SE	2.120 ±0.016	7.620 ±1.12	0.288a ±0.044
% (+/-)	(-9.78)	(-22.87)	(+21.08)
100mM NaCl, Mean, SE	1.310 ±0.069	6.280 ±0.612	0.211a ±0.201
% (+/-)	(-44.25)	(-36.43)	(-10.99)
$LSD_{0.05}$	0.506	2.130	3.870

Set II= 0.25ppm BRs applied through roots.

Treatment	Total stem dryWt (gms)	Total plant dry Wt (gms)	Stem Weight Ratio
Control, Mean, SE	2.380 ±0.016	11.26 ±0.048	0.211a ±0.0005
60mM NaCl, Mean, SE	2.155 ±0.036	9.795 ±0.118	0.2201a ±0.006
% (+/-)	(-9.45)	(-13.01)	(+4.14)
100mM NaCl, Mean, SE	1.50 ±0.326	6.705 ±0.273	0.223a ±0.034
% (+/-)	(-36.97)	(-40.45)	(+5.93)
$LSD_{0.05}$	0.440	0.680	0.665

Set III= 0.50ppm BRs applied through roots.

Treatment	Total stem dryWt (gms)	Total plant dry Wt (gms)	Stem Weight Ratio
Control, Mean, SE	2.625 ±0.224	12.375 ±0.004	0.212a ±0.018
60mM NaCl, Mean, SE	1.675 ±0.134	9.585 ±0.355	0.175ab ±0.02
% (+/-)	(-36.19)	(-22.54)	(-17.08)
100mM NaCl, Mean, SE	1.635 ±0.889	6.715 ±0.518	0.243b ±0.001
% (+/-)	(-37.71)	(-45.73)	(+14.84)
$LSD_{0.05}$	0.489	1.010	3.450

Set IV= 0.25ppm BRs applied foliarly.

Treatment	Total stem dryWt (gms)	Total plant dry Wt (gms)	Stem Weight Ratio
Control, Mean, SE	2.0 ±0.073	10.575 ±0.208	0.189a ±0.01
60mM NaCl, Mean, SE	1.81 ±0.048	8.90 ±0.187	0.203a ±0.001
% (+/-)	(-9.5)	-15.839	(+7.33)
100mM NaCl, Mean, SE	1.496 ±0.234	6.591 ±0.18	0.228a ±0.02
% (+/-)	(-25.2)	(-37.678)	(-20.354)
$LSD_{0.05}$	0.227	0.930	1.220

Set V= 0.50 ppm BRs applied foliarly.

Treatment	Total stem dryWt (gms)	Total plant dry Wt (gms)	Stem Weight Ratio
Control, Mean, SE	1.74 ±0.048	10.13 ±0.465	0.171a ±0.003
60mM NaCl, Mean, SE	1.375 ±0.02	7.67 ±1.21	0.186a ±0.032
% (+/-)	(-20.97)	(-24.28)	(+8.71)
100mM NaCl, Mean, SE	1.20 ±0.142	5.70 ±0.195	0.2109a ±0.07
% (+/-)	(-31.03)	(-43.73)	(+22.67)
$LSD_{0.05}$	0.099	1.914	2.03

Means followed by different letters in the same column differ significantly at 95% probability level according to New Duncan's Multiple Range Test. Figures in parentheses indicate % promotion (+) and reduction (-) over control.

Plants grown in Set III-V showed significant ($P< 0.05$) increase in 60 and 100mM NaCl stress as compare to control (Table 5).

When we compare Set II with Set III plants of Set II showed increase in 60mM NaCl stress while decrease in 100mM NaCl stress as compare to control. Comparison between Set IV and V showed that plants of Set IV increase in non-saline control and result of 60 and 100mM NaCl stress remains the same in both sets. If we compare Set II, Set III, Set IV and V with Set I we observed that plants of all four sets showed increase in 60mM NaCl stress while decrease in 100mM NaCl stress.

3.3.12 Stem weight ratio (SWR)

Plants grown in Set I showed non-significant increase in 60mM NaCl stress while non significant decrease over 100mM NaCl stress as compare to non saline control. Plants grown in Set III showed significant ($P<0.05$) decrease in 60mM NaCl stress and 100mM NaCl stress as compare to control. Plants grown in Set II, Set IV and V showed non-

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Table 7. Effect of BRs and different NaCl concentrations on leaf weight ratio of *Lycopersicon esculentum.*

Set I= Without BRs

Treatment	Total leaves dry Wt (gms)	Total plant dry Wt (gms)	Leaf Weight Ratio
Control, Mean, SE	3.505a ±0.077	9.88a ±0.114	0.354a ±0.003
60mM NaCl, Mean, SE	3.365ab ±0.028	7.62ab ±1.12	0.457a ±0.071
% (+/-)	(-3.99)	(-22.87)	(+28.96)
100mM NaCl, Mean, SE	2.905b ±0.069	6.28b ±0.612	0.475a ±0.201
% (+/-)	(-17.11)	(-36.43)	(+33.96)
$LSD_{0.05}$	0.563	2.130	0.264

Set II= 0.25ppm BRs applied through roots

Treatment	Total leaves dry Wt (gms)	Total plant dry Wt (gms)	Leaf Weight Ratio
Control, Mean, SE	4.005a ±0.036	11.26a ±0.048	0.355a ±0.001
60mM NaCl, Mean, SE	3.685b ±0.036	9.795b ±0.118	0.376b ±0.008
% (+/-)	(-7.99)	(-13.01)	(+5.81)
100mM NaCl, Mean, SE	3.2b ±0.326	6.705c ±0.273	0.476b ±0.034
% (+/-)	(-20.09)	(-40.45)	(+34.09)
$LSD_{0.05}$	0.460	0.680	0.676

Set III= 0.50ppm BRs applied through roots.

Treatment	Total leaves dry Wt (gms)	Total plant dry Wt (gms)	Leaf Weight Ratio
Control, Mean, SE	4.45a ±0.204	12.37a ±0.004	0.359a ±0.016
60mM NaCl, Mean, SE	3.55b ±0.367	9.58b ±0.355	0.368b ±0.024
% (+/-)	(-20.22)	(-22.54)	(+2.61)
100mM NaCl, Mean, SE	3.18b ±0.889	6.71c ±0.518	0.476b ±0.29
% (+/-)	(-28.53)	(-45.73)	(+32.64)
$LSD_{0.05}$	1.024	0.660	1.552

Set IV= 0.25 ppm BRs applied foliarly.

Treatment	Total leaves dry Wt (gms)	Total plant dry Wt (gms)	Leaf Weight Ratio
Control, Mean, SE	3.97a ±0.053	10.57a ±0.208	0.375a ±0.002
60mM NaCl, Mean, SE	3.11a ±0.069	8.9b ±0.187	0.35b ±0.015
% (+/-)	(-21.63)	(-15.83)	(-6.77)
100mM NaCl, Mean, SE	3.48a ±0.234	6.59c ±0.18	0.532b ±0.02
% (+/-)	(-12.302)	(-37.67)	(+41.506)
$LSD_{0.05}$	0.614	0.920	0.667

Set V= 0.50 ppm BRs applied foliarly.

Treatment	Total leaves dry Wt (gms)	Total plant dry Wt (gms)	Leaf Weight Ratio
Control, Mean, SE	3.505a ±0.257	10.13a ±0.465	0.348a ±0.041
60mM NaCl, Mean, SE	2.81a ±0.743	7.67b ±1.216	0.356b ±0.04
% (+/-)	(-19.82)	(-24.28)	(+2.27)
100mM NaCl, Mean, SE	3.11a ±0.142	5.7c ±0.195	0.546b ±0.07
% (+/-)	(-19.82)	(-24.28)	(+56.69)
$LSD_{0.05}$	1.160	1.910	0.607

Means followed by different letters in the same column differ significantly at 95% probability level according to New Duncan's Multiple Range Test. Figures in parentheses indicate % promotion (+) and reduction (-) over control.

significant increase in 60 and 100mM NaCl stress over their control (Table 6).

When we compare set II with Set III plants of Set II showed decrease in non saline control while increase in 60 and 100mM NaCl stress. Comparison between Set IV and V showed that plants of Set IV showed increase in all treatments. If we compare Set II, Set III, Set IV and V with Set I we observed that plants of all four sets showed increase in non-saline control and 60mM NaCl stress as compare to Set I.

3.3.13 Leaf weight ratio (LWR)

Plants grown in Set I showed non-significant increase in 60 and 100mM NaCl stress over control while Set II, III and V showed significant ($P<0.05$) increase in 60 and 100mM NaCl stress as compare to control. Plants grown in Set IV showed significant ($P<0.05$) decrease in 60mM NaCl stress

Table 8. Effect of BRs and different NaCl concentrations on leaf area ratio of *Lycopersicon esculentum.*

Set I= Without BRs.

Treatment	Leaf Area (mm^2)	Total plant dry Wt (gms)	Leaf Area Ratio
Control, Mean, SE	21.85a ±0.187	9.88a ±0.114	2.211a ±0.006
60mM NaCl, Mean, SE	15.95b ±0.187	7.62b ±1.126	2.170a ±0.345
% (+/-)	(-26.97)	(-22.87)	(-1.86)
100mM NaCl, Mean, SE	13.515c ±0.069	6.28b ±0.612	2.18a ±0.201
% (+/-)	(-38.14)	(-36.43)	(-1.36)
$LSD_{0.05}$	0.543	2.130	0.650

Set II= 0.25 ppm BRs applied through roots.

Treatment	Leaf Area (mm^2)	Total plant dry Wt (gms)	Leaf Area Ratio
Control, Mean, SE	22.56a ±0	11.26a ±0.048	2.003a ±0.008
60mM NaCl, Mean, SE	16.15b ±0.155	9.795b ±0.118	1.649a ±0.035
% (+/-)	(-28.41)	(-13.01)	(-17.67)
100mM NaCl, Mean, SE	13.6c ±0.326	6.705c ±0.273	2.03a ±0.034
% (+/-)	(-39.71)	(-40.452)	(+1.33)
$LSD_{0.05}$	0.620	0.680	0.142

Set III= 0.50 ppm BRs applied through roots.

Treatment	Leaf Area (mm^2)	Total plant dry Wt (gms)	Leaf Area Ratio
Control, Mean, SE	22.4325a ±0.087	12.375a ±0.004	1.812a ±0.006
60mM NaCl, Mean, SE	16.3125b ±0.177	9.585b ±0.355	1.704a ±0.044
% (+/-)	(-27.28)	(-22.54)	(-5.97)
100mM NaCl, Mean, SE	13.49c ±0.889	6.715c ±0.518	2.011a ±1.98
% (+/-)	(-39.86)	(-45.73)	(+10.96)
$LSD_{0.05}$	1.500	1.025	0.160

Set IV= 0.25 ppm BRs applied foliarly.

Treatment	Leaf Area (mm^2)	Total plant dry Wt (gms)	Leaf Area Ratio
Control, Mean, SE	21.34a ±0	7.05a ±3.52	2.019a ±0.039
60mM NaCl, Mean, SE	15.97b ±0.253	8.9b ±0.187	1.796a ±0.066
% (+/-)	(-25.16)	(+26.24)	(-11.02)
100mM NaCl, Mean, SE	13.652c ±0.234	6.59c ±0.18	2.072a ±0.021
% (+/-)	(-36.02)	(-6.51)	(+2.63)
$LSD_{0.05}$	0.770	0.930	1.220

Set V= 0.50 ppm BRs applied foliarly.

Treatment	Leaf Area (mm^2)	Total plant dry Wt (gms)	Leaf Area Ratio
Control, Mean, SE	22.54a ±0.40	10.13a ±0.465	2.229a ±0.062
60mM NaCl, Mean, SE	16.06b ±0.179	7.67b ±1.21	2.181a ±0.369
% (+/-)	(-28.74)	(-24.28)	(-2.13)
100mM NaCl, Mean, SE	14.35c ±0.142	5.7c ±0.195	2.52a ±0.07
% (+/-)	(-36.33)	(-43.73)	(+13.06)
$LSD_{0.05}$	0.80	1.91	0.574

Means followed by different letters in the same column differ significantly at 95% probability level according to New Duncan's Multiple Range Test. Figures in parentheses indicate % promotion (+) and reduction (-) over control.

and significant ($P<0.05$) increase in 100mM NaCl stress as compare to control (Table 7).

When we compare Set II with Set III plants of Set II showed decrease in non-saline control and increase in 60mM NaCl stress as compare to Set III. Comparison between Set IV and V showed that plants of Set IV exhibited increase in non-saline control while decrease in 60 and 100mM NaCl stress. If we compare Set II, Set III, Set IV and V with Set I we observed that plants of Set V showed decrease while remaining all three sets showed increase in non-saline control.

3.3.14 Leaf area ratio (LAR)

Plants grown in Set I showed non-significant decrease in 60 and 100mM NaCl stress over control while plants grown in Set II, III, IV and V showed non-significant decrease in 60mM NaCl stress and non-significant increase in 100mM NaCl stress as compare to control (Table 8). When we compare Set II with Set II plants of Set II showed increase in non-saline control and 100mM NaCl stress while

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Table 9. Effect of BRs and different NaCl concentrations on specific leaf area of *Lycopersicon esculentum.*

Set I= Without BRs

Treatment	Leaf Area (mm^2)	Total leaf dry Wt (gms)	Specific Leaf Area
Control, Mean, SE	21.850 ±0.187	3.505 ±0.077	6.236a ±0.084
60mM NaCl, Mean, SE	15.955 ±0.187	3.365 ±0.028	4.74a ±0.015
% (+/-)	(-26.97)	(-3.99)	(-23.97)
100mM NaCl, Mean, SE	13.515 ±0.069	2.905 ±0.612	4.71a ±0.201
% (+/-)	(-38.14)	(-17.11)	(-24.52)
$LSD_{0.05}$	0.543	0.563	0.964

Set II= 0.25 ppm BRs applied through roots.

Treatment	Leaf Area (mm^2)	Total leaf dry Wt (gms)	Specific Leaf Area
Control, Mean, SE	22.56a ±0	4.005a ±0.036	5.63a ±0.051
60mM NaCl, Mean, SE	16.15b ±0.155	3.685b ±0.036	4.38b ±0.001
% (+/-)	(-28.41)	(-7.99)	(-22.20)
100mM NaCl, Mean, SE	13.6c ±0.326	3.2c ±0.273	4.258b ±0.034
% (+/-)	(-39.71)	(-20.09)	(-24.40)
$LSD_{0.05}$	0.620	0.464	0.661

Set III=0.50 ppm BRs applied through roots.

Treatment	Leaf Area (mm^2)	Total leaf dry Wt (gms)	Specific Leaf Area
Control, Mean, SE	22.43a ±0.087	4.45a ±0.204	3.582a ±1.41
60mM NaCl, Mean, SE	16.312b ±0.177	3.55b ±0.367	4.132a ±0.432
% (+/-)	(-27.28)	(-20.22)	(+15.34)
100mM NaCl, Mean, SE	13.49c ±0.889	3.18c ±0.518	4.237a ±0.214
% (+/-)	(-39.86)	(-28.53)	(+18.26)
$LSD_{0.05}$	1.50	1.025	0.94

Set IV=0.25 ppm BRs applied foliarly.

Treatment	Leaf Area (mm^2)	Total leaf dry Wt (gms)	Specific Leaf Area
Control, Mean, SE	21.34a ±0	3.97a ±0.053	5.369a ±0.071
60mM NaCl, Mean, SE	15.97b ±0.253	3.115b ±0.069	5.127a ±0.032
% (+/-)	(-25.16)	(-21.63)	(-4.50)
100mM NaCl, Mean, SE	13.652c ±0.234	6.59c ±0.18	3.967b ±0.02
% (+/-)	(-36.02)	(+65.79)	(-26.126)
$LSD_{0.05}$	0.770	0.924	1.130

Set V=0.50 ppm BRs applied foliarly.

Treatment	Leaf Area (mm^2)	Total leaf dry Wt (gms)	Specific Leaf Area
Control, Mean, SE	22.54a ±0.40	3.505a ±0.257	6.49a ±0.59
60mM NaCl, Mean, SE	16.06b ±0.179	2.81b ±0.743	6.413a ±1.75
% (+/-)	(-28.74)	(-28.74)	(-19.82)
100mM NaCl, Mean, SE	14.35c ±0.142	3.11c ±0.195	4.61a ±0.07
% (+/-)	(-36.33)	(-11.26)	(-28.96)
$LSD_{0.05}$	0.77	0.924	1.13

Means followed by different letters in the same column differ significantly at 95% probability level according to New Duncan's Multiple Range Test. Figures in parentheses indicate % promotion (+) and reduction (-) over control.

showed decrease in 60mM NaCl stress. Comparison between Set IV and V showed that plants of Set IV showed decrease in non-saline control and 60mM NaCl stress increase in 100mM NaCl stress. If we compare Set II, Set III, Set IV and V with Set I we observed that plants of Set V showed increase while remaining all three sets showed decrease in non-saline control, 60 and 100mM NaCl stress.

3.3.15 Specific leaf area (SLA)

Plants grown in Set I and Set III showed non-significant decrease while Set II and IV showed significant ($P<0.05$) decrease in 60 and 100mM NaCl stress as compare to their respective control. Plants grown in Set IV showed non-significant increase while Set V showed significant ($P<0.05$) decrease in 60mM NaCl stress and 100mM NaCl stress as compare to their respective control (Table 9).

When we compare Set II with Set III plants of Set II showed increase in non-saline control and 100mM NaCl stress while showed decrease in 60mM NaCl stress. Comparison between Set IV and V showed that plants of Set IV showed decrease in non-saline control and 60mM NaCl stress while increase in 100mM NaCl stress. If we compare Set II, Set III, Set IV and V with Set I we observed that plants of Set V showed increase while remaining all three sets showed decrease in non-saline control. If we compare Set II, Set III, Set IV and V with Set I we observed that plants of Set II-III showed decrease in 60mM NaCl stress while increase in Set VI-V in 60mM NaCl stress. Plants of all four sets showed decrease in 100mM NaCl stress as compare to Set I.

4 CONCLUSION

The germination response was studied on different salinity levels from control (non-saline), 0.2,0.4,0.6 and 0.8% NaCl solution. Seeds germinating under salt stress exhibited decrease in saline media as compared to respective control. Seeds germinating with salinity and brassinosteroid (applied exogenously through roots and as foliar spray, 0.25 and 0.5ppm) exhibited promotion in control as compared to their respective saline media. Plants treated with different salts concentrations (60 and 100mM) NaCl exhibited reduction in plant height, root length, number of leaves, number of fruits and biomass as compared to control while brassinosteroid @ 0.25 and 0.5 ppm (applied through roots and as foliar spray) caused promotion in plant height, root length, number of leaves, number of fruits and biomass in saline and non saline media. Plants treated with different salts concentration of (60 and 100mM) NaCl exhibited increase in Relative water content, leaf water loss, electrolyte leakage, shoot root ratio, root weight ratio and leaf weight ratio at both NaCl concentrations (60 and 100 mM) as compared to control, while stem weight ratio showed reduction at both salinity levels as compared to control while brassinosteroid applied in roots and as a foliar spray at 0.25 and 0.5 ppm concentrations exhibited reduction in stem weight ratio at high NaCl level (100 mM) as compared to control.

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Conflict of Interest

The authors have declared that there is no conflict of interest.

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